

## **Cooperative Gust Sensing and Suppression for Aircraft Formation Flight**

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### **Project Overview**

Aircraft formation flight has great potential for future commercial applications because of its documented benefits in reducing drag and increasing throughputs. For example, a fuel saving up to of 14% for the trailing aircraft was demonstrated in 2001 by the NASA Autonomous Formation Flight (AFF) program. The reduced fuel consumption along with the associated lower environmental impact can help the development of a sustainable air transportation industry. Additionally, formation flight could also allow air traffic control systems to handle increased traffic in the next generation airspace.

One of the critical technical issues to be addressed before commercial aircraft can routinely fly in formation is the turbulence suppression problem. In fact, since the trailing aircraft is always flying in the wingtip vortex of a leading aircraft, the design and operational implementation of turbulence active suppression systems is important for both flight safety and passenger comfort. From a different perspective, the extended spatial sensing range with a group of aircraft also creates new opportunities for the cooperative sensing and suppression of ambient atmospheric gusts and turbulences, which has been a leading cause of in-flight injuries.

### **Objective**

The key objective of this research effort is the development of a cooperative strategy for gust sensing and suppression within a formation flight setting. Specifically, each trailing aircraft will analyze real-time flight data collected from leading aircraft to estimate the effects of ambient and wake turbulences on its airframe. An active gust suppression controller will then be implemented with the goal of minimizing the on-board disturbances. The proposed gust sensing and suppression system will be developed and simulated during Phase I of the project, and experimentally validated on formation flying sub-scale aircraft during Phase II.